AD-A132 090 DEP(DRYING ECONOMICS PROGRAM) A COMPUTER PROGRAM FOR EVALUATING LUMBER DRYING COSTS AND INVESTMENTS(U) FOREST PRODUCTS LAB MADISON WI S HOLMES ET AL. JUL 83 1/1

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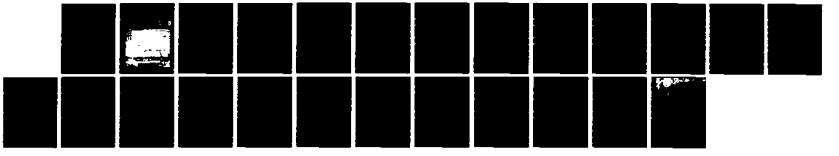

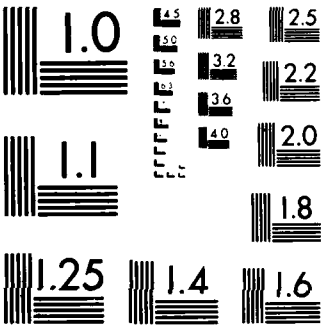

United States
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General
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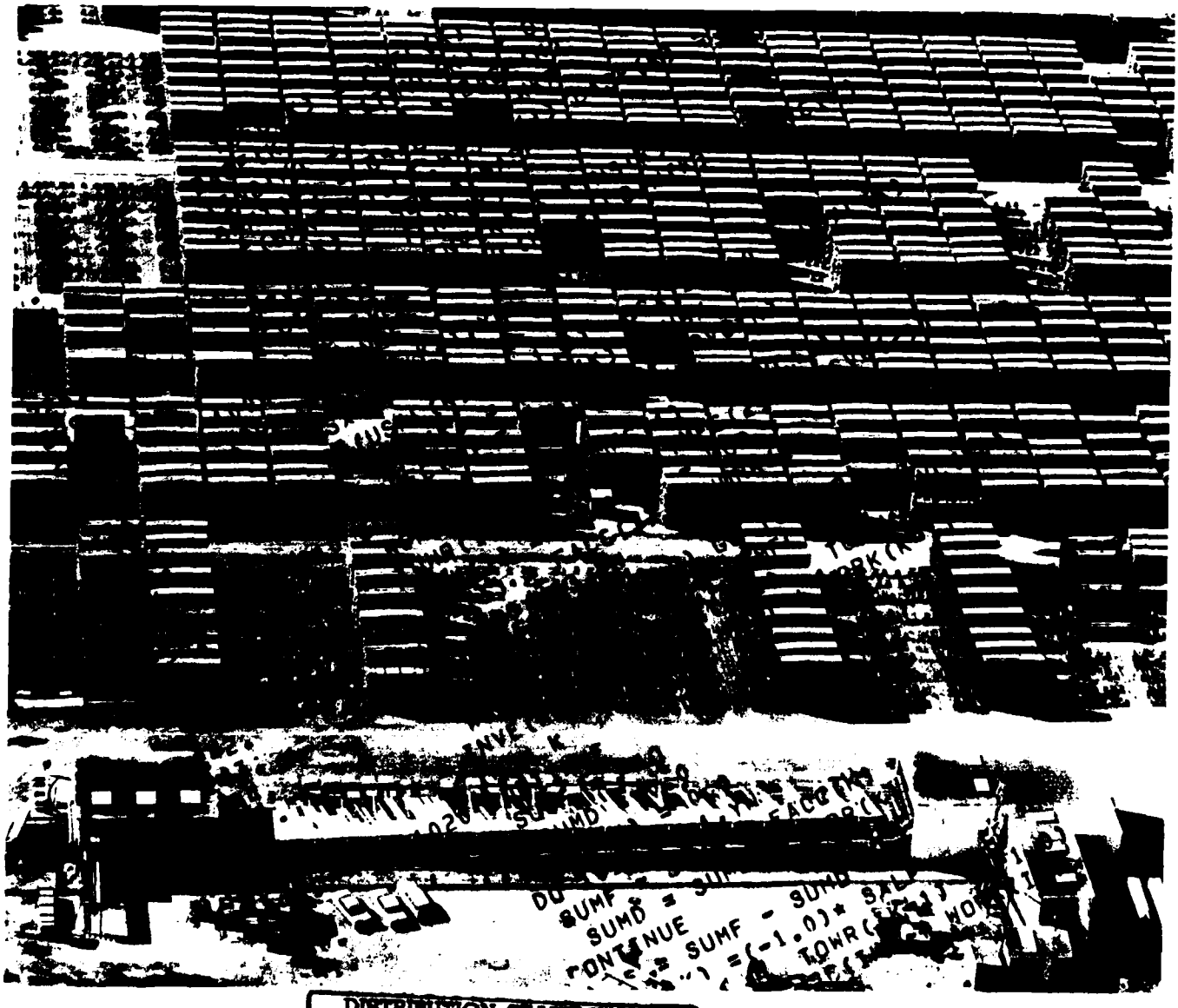
DEP
A Computer Program for Evaluating Lumber Drying Costs and Investments



Abstract

The DEP computer program is a modified discounted cash flow computer program designed for analysis of problems involving economic analysis of wood drying processes. Wood drying processes are different from other processes because of the large amounts of working capital required to finance inventories, and because of relatively large shares of costs charged to inventory insurance and tax. DEP's flexibility allows calculation of rate of return, break-even transfer prices, or break-even facilities costs. Data input requirements are simplified into basic analytical components that are explained and illustrated with example analyses.

United States
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July 1983

DEP
A Computer Program for Evaluating Lumber Drying Costs and Investments

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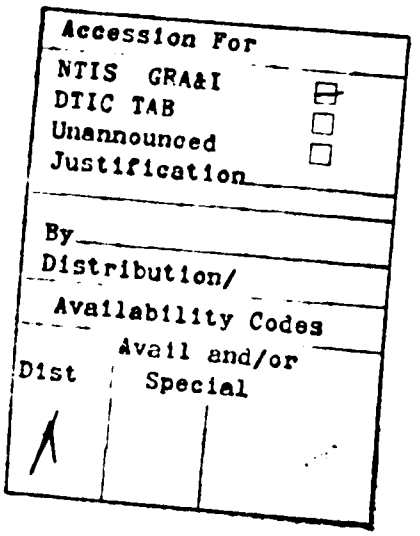

Introduction

Because of the time and energy required for drying lumber, drying costs are typically among the highest in wood products manufacturing. If current trends in costs of working capital and energy continue, drying costs can be expected to become an increasingly larger part of the total manufacturing cost unless more effective lumber drying practices can be identified.

Analysis of such problems is a complex process requiring identification of investment and processing costs associated with the value added by lumber drying. We developed DEP (**D**rying **E**conomics **P**rogram) to meet the computational needs for such analyses. In this publication we describe the use of the DEP computer program and offer examples of analyses.

Program

DEP, written in Fortran for use on UNIVAC 1108 and 1110 systems (appendix C), is basically a discounted cash flow model. It differs from other discounted cash flow computer programs because of the explicit computational requirements of drying projects to provide for large and variable amounts of working capital investment in lumber inventories, associated operating costs in inventory insurance and taxes, and because of the energy-intensive characteristics of drying processes.

In general, DEP is designed to compute the after-tax time value of investment capital, operating costs, and revenue cash flows in terms of four principal types of investment criteria: (1) present value of the investment, (2) rate of return on investment (table 1), (3) total unit cost(s) of production including taxes and profit (table 2), and (4) maximum investment(s) that can be made to obtain a minimally attractive rate of return (table 3).

The present value of the investment (PVI) is defined by the discount rate used. PVI is the present value, or net present worth, of the stream of annual net cash flows discounted by the discount rate. If the discount rate is the same as the rate of return that could be realized from alternative investments with similar risk (the opportunity cost of money capital), PVI may be used as a basis for comparing alternative investment opportunities.

Rate-of-return (ROR) criteria for DEP are of two types. Internal ROR is the particular rate of interest required to discount the stream of annual net cash flows to a present value of zero (tables 1 and 2). For complex investment projects where there may be more than one internal ROR, DEP will compute only the internal ROR closest to the discount rate used. The second type of ROR is a composite that expresses the ROR-to-equity capital invested at the initiation of a project (table 3). This is referred to as a composite because it is computed as an ROR-to-equity capital as a composite of the rate of interest specified for monies that may be borrowed to finance the project and the rate of interest specified for reinvested cash surpluses.

The total unit cost of production (cost per dry unit of lumber processed) is the price-volume-cost break-even unit product price(s) required to yield an after-tax profit consistent with either the internal or composite ROR. The break-even

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[1] Maintained at Madison, Wis., in cooperation with the University of Wisconsin.

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Table 1.—DEP output of cash flows and associated internal rates of return

AIR-DRYING FACILITIES+ADD 10 ACRES
(INVESTMENT TAX CREDIT OF $ 12000. CONSIDERED.)

INITIAL INVESTMENT--YEAR 0	EFFECTIVE TAX RATE .5268	ORIGINAL CASH EQUITY	$ 0.	V.C./TOT TRAN REV=	.6320
FACILITIES COST $ 1327000.	BORROWING RATE .0000	ENDING VALUE OF EQUITY	$39734956.	F.C./TOT TRAN REV=	.0040
WORKING CAPITAL $ 9964438.	REINVESTMENT RATE .0000	FACILITIES SALVAGE VALUE	$ 755600.	DEPR./T.T.R. =	.0039
TOTAL INVEST. $11291437.	INTERNAL ROR .2630	P.V. OF INVEST.(I=.1500)	$ 8041614.	TAX COSTS/T.T.R. =	.1897
				A.T. PROFIT/T.R. =	.1705

FINANCIAL SUMMARY

YEAR-END VALUES . . .	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10
YARD THRUPUT	45000.	45000.	45000.	45000.	45000.	45000.	45000.	45000.	45000.	45000.
TRANS. PRICE/UNIT $	375.00 $	401.00 $	429.00 $	459.00 $	492.00 $	526.00 $	563.00 $	602.00 $	644.00 $	689.00
TOT TRAN REVENUE$	16874999.$	18044999.$	19304998.$	20654998.$	22139999.$	23669998.$	25334998.$	27089998.$	28979998.$	31004998.
INTEREST INC-EXP	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
MAT. & HANDL. COST $	10113704.$	10821488.$	11579127.$	12389891.$	13257048.$	14185095.$	15178117.$	16240201.$	17377068.$	18593622.
INV. TAX & INSUR.	148085.	158448.	169542.	181413.	194110.	207698.	222238.	237789.	254435.	272248.
LABOR COST	400570.	428610.	458613.	490715.	525066.	561820.	601148.	643228.	688254.	736432.
TOTAL VAR COST $	10662359.$	11408546.$	12207281.$	13062018.$	13976224.$	14954613.$	16001502.$	17121218.$	18319756.$	19602301.
UNIT VAR COST $	236.94 $	253.52 $	271.27 $	290.27 $	310.58 $	332.32 $	355.59 $	380.47 $	407.11 $	435.61
PROFIT CONTRIB. $	6212639.$	6636452.$	7097717.$	7592980.$	8163775.$	8715386.$	9333496.$	9968780.$	10660242.$	11402697.
FIXED MFG COST $	180.$	193.$	206.$	221.$	236.$	252.$	270.$	289.$	309.$	331.
OVERHEAD COST	66820.	71497.	76502.	81857.	87587.	93719.	100279.	107298.	114809.	122846.
TOTAL F.C. $	67000.$	71690.$	76708.$	82078.$	87823.$	93971.$	100549.$	107587.$	115118.$	123177.
FACILITIES COST $	0.$	0.$	0.$	0.$	147800.$	0.$	0.$	0.$	193880.$	-755600.
WORKING CAPITAL	697345.	746452.	798788.	854365.	914347.	978363.	1046424.	1120086.	1198593.	-18319202.
INVESTMENT $	697345.$	746452.$	798788.$	854365.$	1062147.$	978363.$	1046424.$	1120086.$	1392473.$	-19074802.
DEPRECIATION $	83950.$	83950.$	83950.$	83950.$	92470.$	92470.$	92470.$	92470.$	103700.$	103700.
AFTER TAX PROFIT $	2880392.$	3066721.$	3282616.$	3514434.$	3777784.$	4035897.$	4325274.$	4622560.$	4940882.$	5288398.
A.T. EARNINGS	2964341.	3150671.	3366566.	3598384.	3870254.	4128367.	4417744.	4715030.	5044582.	5392098.
A.T. NET CASH FLOW	2266996.	2404219.	2567779.	2744019.	2808107.	3150003.	3371319.	3594944.	3652108.	24466900.
ACUM NET CASH FLOW $	-9024.4M $	-6620.2M $	-4052.4M $	-1308.4M $	1499.7M $	4649.7M $	8021.0M $	11615.9M $	15268.1M $	39735.0M

SENSITIVITY ANALYSIS

	INTERNAL RATES OF RETURN AT ADJUSTED INPUT VALUES				
	80 PCT	90 PCT	100 PCT	110 PCT	120 PCT
TRANS. PRICE/UNIT	.250	.257	.263	.269	.273
YARD THRUPUT	.119	.191	.263	.335	.407
UNIT VAR COST	.431	.339	.263	.200	.146
TOTAL F.C.	.264	.264	.263	.263	.263
FACILITIES COST	.269	.266	.263	.261	.258

Table 2.—DEP output of cost cash flows and computed revenues required to realize a 15 percent after-tax internal rate of return

AIR-DRYING FACILITIES+ADD 10 ACRES
(INVESTMENT TAX CREDIT OF $ 12000. CONSIDERED.)

INITIAL INVESTMENT--YEAR 0	EFFECTIVE TAX RATE .5268	ORIGINAL CASH EQUITY	$ 0.	V.C./TOT TRAN REV=	.7496
FACILITIES COST $ 1327000.	BORROWING RATE .0000	ENDING VALUE OF EQUITY	$22433604.	F.C./TOT TRAN REV=	.0047
WORKING CAPITAL $ 9964437.	REINVESTMENT RATE .0000	FACILITIES SALVAGE VALUE	$ 755600.	DEPR./T.T.R. =	.0046
TOTAL INVEST. $11291437.	INTERNAL ROR .1500	P.V. OF INVEST.(I=.1500)	$ -0.	TAX COSTS/T.T.R. =	.1269
				A.T. PROFIT/T.R. =	.1141

OPERATING CASH FLOWS WHERE COSTS = REVENUES

YEAR-END VALUES . . .	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10
YARD THRUPUT	45000.	45000.	45000.	45000.	45000.	45000.	45000.	45000.	45000.	45000.
TRANS. PRICE/UNIT $	316.18 $	338.10 $	361.71 $	387.00 $	414.83 $	443.50 $	474.69 $	507.57 $	542.99 $	580.93
TOT TRAN REVENUES $	14228103.$	15214585.$	16276950.$	17415198.$	18667271.$	19957286.$	21361125.$	22840848.$	24434396.$	26141768.
INTEREST INC-EXP	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
MAT. & HANDL. COST $	10113704.$	10821488.$	11579127.$	12389890.$	13257048.$	14185094.$	15178116.$	16240201.$	17377067.$	18593622.
INV. TAX & INSUR.	148085.	158448.	169542.	181413.	194110.	207698.	222238.	237789.	254435.	272248.
LABOR COST	400570.	428610.	458613.	490715.	525066.	561820.	601148.	643228.	688254.	736432.
TOTAL VAR COST $	10662359.$	11408546.$	12207281.$	13062018.$	13976224.$	14954612.$	16001502.$	17121218.$	18319756.$	19602301.
UNIT VAR COST $	236.94 $	253.52 $	271.27 $	290.27 $	310.58 $	332.32 $	355.59 $	380.47 $	407.11 $	435.61
PROFIT CONTRIB. $	3565744.$	3806039.$	4069669.$	4353180.$	4691048.$	5002673.$	5359623.$	5719630.$	6114640.$	6539467.
FIXED MFG COST $	180.$	193.$	206.$	221.$	236.$	252.$	270.$	289.$	309.$	331.
OVERHEAD COST	66820.	71497.	76502.	81857.	87587.	93719.	100279.	107298.	114809.	122846.
TOTAL F.C. $	67000.$	71690.$	76708.$	82078.$	87823.$	93971.$	100549.$	107587.$	115118.$	123177.
FACILITIES COST $	0.$	0.$	0.$	0.$	147800.$	0.$	0.$	0.$	193880.$	-755600.
WORKING CAPITAL	697345.	746452.	798787.	854365.	914347.	978363.	1046424.	1120086.	1198593.	-18319202.
INVESTMENT $	697345.$	746452.$	798787.$	854365.$	1062147.$	978363.$	1046424.$	1120086.$	1392473.$	-19074801.
DEPRECIATION $	83950.$	83950.$	83950.$	83950.$	92470.$	92470.$	92470.$	92470.$	103700.$	103700.
AFTER TAX PROFIT $	1627881.$	1727369.$	1849744.$	1981360.$	2134489.$	2279041.$	2444837.$	2611862.$	2789903.$	2987118.
A.T. EARNINGS	1711831.	1811319.	1933694.	2065310.	2226959.	2371511.	2537307.	2704332.	2893603.	3090818.
A.T. NET CASH FLOW	1014485.	1064867.	1134906.	1210945.	1164812.	1393148.	1490883.	1584246.	1501129.	22165619.
ACUM NET CASH FLOW $	-10277.0M $	-9212.1M $	-8077.2M $	-6866.2M $	-5701.4M $	-4308.3M $	-2817.4M $	-1233.1M $	268.0M $	22433.6M

SENSITIVITY ANALYSIS

INTERNAL RATES OF RETURN AT ADJUSTED INPUT VALUES

	80 PCT	90 PCT	100 PCT	110 PCT	120 PCT
TRANS. PRICE/UNIT	.141	.146	.150	.153	.157
YARD THRUPUT	.026	.089	.150	.211	.272
UNIT VAR COST	.294	.215	.150	.096	.049
TOTAL F.C.	.150	.150	.150	.150	.150
FACILITIES COST	.152	.151	.150	.149	.148

Table 3.—DEP output of cash flows (operating costs and revenues) and computed facilities investment that allow a 15 percent after-tax rate of return to equity investment

AIR-DRYING FACILITIES*ADD 10 ACRES
(INVESTMENT TAX CREDIT OF $ 103085. CONSIDERED.)

INITIAL INVESTMENT--YEAR 0	EFFECTIVE TAX RATE .5268	ORIGINAL CASH EQUITY	$10000000.	V.C./TOT TRAN REV=	.6324
FACILITIES COST $11399472.	BORROWING RATE .1600	ENDING VALUE OF EQUITY	$40455928.	F.C./TOT TRAN REV=	.0340
WORKING CAPITAL $10442062.	REINVESTMENT RATE .0800	FACILITIES SALVAGE VALUE	$ 6490913.	DEPR./T.T.R. =	.0336
TOTAL INVEST. $21841534.	COMPOSITE ROR .1500	P.V. OF EQUITY(I=.1500)	$10000088.	TAX COSTS/T.T.R. =	.1693
				A.T. PROFIT/T.T.R=	.1307

FINANCIAL SUMMARY WITH BREAK-EVEN ADJUSTED FACILITIES COST(S), DEPRECIATION AND OVERHEAD

YEAR-END VALUES . . .	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10
YARD THRUPUT	45000.	45000.	45000.	45000.	45000.	45000.	45000.	45000.	45000.	45000.
TRANS. PRICE/UNIT $	375.00 $	401.00 $	429.00 $	459.00 $	492.00 $	526.00 $	563.00 $	602.00 $	644.00 $	689.00
TOT TRAN REVENUES $	16874998.$	18044998.$	19304998.$	20654998.$	22139998.$	23669998.$	25334998.$	27089998.$	28979997.$	31004997.
INTEREST INC-EXP	-1894645.	-1651377.	-1385409.	-1076451.	-719452.	-503016.	-40055.	244511.	535385.	725216.
MAT. & HANDL. COST $	10113704.$	10821488.$	11579127.$	12389890.$	13257048.$	14185094.$	15178116.$	16240201.$	17377067.$	18593622.
INV. TAX & INSUR.	155183.	166043.	177668.	190108.	203414.	217654.	232890.	249187.	266631.	285298.
LABOR COST	400570.	428610.	458613.	490715.	525066.	561820.	601148.	643228.	688254.	736432.
TOTAL VAR COST $	10669457.$	11416141.$	12215408.$	13070713.$	13985528.$	14964568.$	16012155.$	17132616.$	18331952.$	19615351.
UNIT VAR COST $	237.10 $	253.69 $	271.45 $	290.46 $	310.79 $	332.55 $	355.83 $	380.72 $	407.38 $	435.90
PROFIT CONTRIB. $	4310896.$	4977480.$	5704181.$	6507833.$	7435018.$	8202413.$	9282788.$	10201892.$	11183430.$	12114862.
FIXED MFG COST $	180.$	193.$	206.$	221.$	236.$	252.$	270.$	289.$	309.$	331.
OVERHEAD COST	574011.	614188.	657183.	703185.	752408.	805084.	861438.	921734.	986256.	1055297.
TOTAL F.C. $	574191.$	614381.$	657389.$	703406.$	752644.$	805336.$	861708.$	922023.$	986565.$	1055628.
FACILITIES COST $	0.$	0.$	0.$	0.$	1269662.$	0.$	0.$	0.$	1665508.$	-6490913.
WORKING CAPITAL	730776.	782227.	837065.	895323.	958178.	1025254.	1096596.	1173774.	1256042.	-19197296.
INVESTMENT $	730776.$	782227.$	837065.$	895323.$	2227840.$	1025254.$	1096596.$	1173774.$	2921550.$	-25688208.
DEPRECIATION $	721165.$	721165.$	721165.$	721165.$	794355.$	794355.$	794355.$	794355.$	890825.$	890825.
AFTER TAX PROFIT $	1530039.$	1723363.$	2046887.$	2405400.$	2786211.$	3124408.$	3608967.$	4015346.$	4403618.$	4811691.
A.T. EARNINGS	2251203.	2444528.	2768052.	3126565.	3580566.	3918763.	4403322.	4809701.	5294443.	5702516.
A.T. NET CASH FLOW	1520427.	1662301.	1930987.	2231242.	1352725.	2893509.	3306726.	3635927.	2372893.	31390725.
ACUM NET CASH FLOW	$-20321.1M	$-18658.8M	$-16727.8M	$-14496.6M	$-13143.9M	$-10250.3M	$ -6943.6M	$ -3307.7M	$ -934.8M	$ 30455.9M
BEGINING-OF-YEAR VALUES FOR MONIES . . .										
BORROWED $	11841.5M $	10321.1M $	8658.8M $	6727.8M $	4496.6M $	3143.9M $	250.3M $	.0M $	.0M $	.0M
REINVESTED $	.0M $	.0M $	.0M $	.0M $	.0M $	.0M $	.0M $	3056.4M $	6692.3M $	9065.2M

SENSITIVITY ANALYSIS

COMPOSITE RATES OF RETURN AT ADJUSTED INPUT VALUES

	80 PCT	90 PCT	100 PCT	110 PCT	120 PCT
TRANS. PRICE/UNIT	.122	.137	.150	.162	.173
YARD THRUPUT	.011	.101	.150	.183	.210
UNIT VAR COST	.194	.174	.150	.117	.068
TOTAL F.C.	.153	.151	.150	.148	.147
FACILITIES COST	.172	.160	.150	.141	.133

price(s) indicate(s) the price(s) at which products must be sold to allow for selling, operating, tax, and capital recovery costs as well as the profits prescribed by the discount rate used.

The maximum investment(s) that can be made and still yield a minimally attractive ROR is again a price-volume-cost break-even calculation. In DEP, total investment is defined as the sum of the facilities and working capital investment requirements. To obtain the maximum investment amount(s), overhead and depreciation data inputs are adjusted to correspond to the facilities costs as fixed percentages (table 3).

Data Requirements

Eighteen input variables must be assigned values in the data deck. The user must specify output and sequential analysis options. Blank coding forms are given in appendix A. An explanation of input variables is in appendix B.

The data deck consists of five types of data cards (figs. 1 and 2).

CARD TYPE 1: Title card. One card only.
The title names the investment project analyzed.

CARD TYPE 2: Data and program control card. One card only.
The Type 2 card is used to enter two types of DEP data: (1) Costs and investment estimating factors that can be assumed to remain constant over the period of analysis and (2) values that will be used by the program to select the types of analyses to be run and to specify the number of output copies to be printed.

Inventory Tax

Inventory tax is the tax rate applied to the drying lumber in inventory when taxes are assessed (the basis upon which taxes are applied will be discussed in the section on "Tax Rate"). The particular tax rate used will depend on the county where the dry or dried lumber is stored. For tax purposes it is usually advantageous to value the lumber at the lower of cost or market.

Working Capital

Working capital is the monies required to maintain raw material, goods in process, and accounts receivable necessary for the future production of revenues. Working capital also includes those operating costs accrued by goods in process and finished products. Operating costs include total fixed and variable costs.

Working capital requirements are a beginning-of-period expense. DEP computes them as year-ending values for the year preceding the period requirements. For this reason the first year's working capital requirements are denoted (in the program output) as Year 0's requirements. This method of assignation and computation continues through each year of the project's life.

Working capital requirements accrue to the lumber starting from the day they enter inventory and end the day they are cash credited. This may be after they are received by a buyer, or when the lumber account is transferred in the books to another division of the same company. Capital requirements include those required for the initial purchase and for all subsequent handling costs. Because lumber must lie idle in the air- and kiln-drying facilities, not being able to use the funds tied up in inventory represents an opportunity cost (return on investment capital) against which final operating profitability must be compared.

The factor used in the program to compute working capital requirements is the weighted average of time lumber remains unredeemed as a cash transaction. Percentage amount of annual lumber throughput in inventory is used as the factor for program computations. This factor is multiplied times the year's annual operating costs to determine working capital requirements.

Under other (perhaps more typical) manufacturing conditions it might be possible to assume a 30-day working capital supply and use the percentage factor 0.0822 ($30 \div 365 = 0.0822$).

Tax Rate

In general a variety of taxes is levied yearly against real and personal property, including inventory. Local tax rates may be different for every county in a state, and because taxes may be applied to real and personal property according to a schedule that may change every year according to inflation and other economic factors, it is necessary to go to company records, or to the local tax assessor, to get accurate data on property evaluation for tax purposes.

Federal and state income taxes typically take about 50 percent of taxable corporate income. Taxes are an important consideration because of their effects on both amounts and timing of after-tax net cash flows—especially when alternatives being considered have equal PVI's or ROR's, or both, on a before-tax basis but not on an after-tax basis. This is most likely when there are such considerations as investment tax credits on new machinery and different state and local tax rates.

The tax rate used in DEP should represent the effective Federal and state income tax rates. This rate is entered in the program and is applied automatically to taxable income.

Discount Rate

The discount rate chosen for calculation of the present value of investment should represent the annual compound rate of return that might reasonably be expected from well chosen investments in other ventures with similar risk. In this way, PVI can be used as a comparative measure of venture profitability. That is, if PVI is zero the venture analyzed is equal in investment earning to alternative opportunities. If PVI is greater the venture analyzed indicates greater dollar earning potential than other alternatives, and vice versa. The discount rate chosen represents the opportunity cost of investment monies required for the financing of inventories and processing costs.

DEP DATA CODING RECORD Date

Estimates prepared by (author) Data confidence level

Project Lumber air-drying facilities Comments

CARD TYPE 1: Title card. First card only, columns 2 through 79.

Data entry Air-Drying - Add 10 Acres

CARD TYPE 2: Data and program control card. Second card only.

Data description	Inventory tax (F6.4)	Working capital (F6.4)	Tax rate (F6.4)	Discount rate (F6.4)	Years considered (12)	Output copies (Max. 9): Financial analysis	Price/cost break-even	Facilities break-even	Original cash investment (F9.0)	Short-term rate: Borrow (F4.4)	Reinvestment (F4.4)	Card
Cols.	1-6	7-12	13-18	19-24	29-30	34	38	42	46-54	58-61	65-68	80
Data Entry	.005	.933	.5268	.15	10	1	1	1	0	0	0	2

CARD TYPE 3: Annual price-volume-cost data. One card for each year, up to 21 cards.

Data description	Unit price (F7.3)	Yard throughput (F8.0)	Material and handling costs (F10.3)	Labor costs (F10.0)	Utilities (F10.0)	Overhead costs (F10.0)	Facilities costs (F10.0)	Investment tax credit depreciation (F10.0)	Year No.	Card
Cols.	1-7	8-15	16-25	26-35	36-45	46-55	56-65	66-75	79	80
Data entries							1,327,000	12,000	0	3
	375	45,000	24,749	400,570	180	66,820		83,950	1	3
	401	45,000	26,481	428,610	193	71,497		83,950	2	3
	429	45,000	28,335	458,613	206	76,502		83,950	3	3
	459	45,000	30,319	490,715	221	81,857		83,950	4	3
	492	45,000	32,441	525,066	236	87,587	147,800	92,470	5	3
	526	45,000	34,712	561,820	252	93,719		92,470	6	3
	563	45,000	37,142	601,148	270	100,279		92,470	7	3
	602	45,000	39,741	643,223	289	107,298		92,470	8	3
	644	45,000	42,523	688,254	309	114,809	103,880	103,700	9	3
	689	45,000	45,500	736,432	331	122,846		103,700		

CARD TYPE 4: Sequential run control card. One card only. Maximum of 10 runs.

Data entry Enter number of sequential runs in columns 9 and 10: 2 4

Figure 1.—DEP input coding example.

DEP DATA CODING RECORD--SEQUENTIAL RUN DATA Date

Prototype project Air-Drying Estimates prepared by

CARD TYPE 5: First year data card. One card for each sequential analysis, up to 10 cards.

Data description	Unit price (F7.3)	Unit sales (F8.0)	Unit manufacturing costs (F10.3)	Other variable costs (F10.0)	Fixed manufacturing costs (F10.0)	Overhead costs (F10.0)	Original cash investment (F10.0)	Short-term rate: Borrow (F5.4)	Reinvestment (F5.4)	Card
Cols.	1-7	8-15	16-25	26-35	36-45	46-55	56-65	66-70	71-75	80
Data entry			224.749							5
			224.749				10,000,000.	.16	.08	5
										5
										5
										5
										5
										5
										5
										5

Figure 2.—DEP data coding example for sequential run analysis.

Years Considered

DEP allows computations based on 2 to 20 years beginning from the time "end of Year 0." The number the user selects will be the investment time frame for the life of the project. It may also be used to provide a standardized time frame that may exceed the useful life of the project but which serves as a basis for comparison with projects having different useful or economic lives.

The "useful life" specified for the project evaluation should be consistent with the concept of economic life and depreciation range used for the facility. The Federal Internal Revenue Service Class Life Asset Depreciation Range may be used for estimating the useful life of a facility. Any modifications, additions, or repairs that would extend the useful life of the facility, or increase its productive capacity, would normally be considered as new investment costs.

Output Copies

DEP will compute and provide printed output for three types of analyses. When the user places a number in one or more of three different positions, the computer is signaled to perform a specific type of analysis. A number from one to nine will indicate the number of copies of printed outputs to be produced.

Financial

The computer figures cash flows before and after taxes and prints associated economic criteria used for decisionmaking.

Price/Cost Break-Even

The computer totals the unit cost of production in terms of the unit price required to generate revenues equal to the associated investment, operating costs, taxes, and profits established by the data inputs.

Facilities Investment Break-Even

The program computes the facilities investment costs, associated levels of overhead cost, depreciation, and working capital requirements that will break even in the context of other values of price-cost-volume data input. Ad valorem overhead costs and depreciation are adjusted as constant percentages of facilities costs. In addition, the program recalculates working capital as necessary based on these adjusted overhead costs.

Original Cash Investment

The original cash investment is the original amount of equity used to initiate a particular project; it may consist of funds from without or within the firm. The program assumes the value to be an end-of-Year-0 amount. That is, that the money is available at the start, and not at some time during the project.

If an amount is entered, DEP computes a composite ROR and, with it, annual interest income and expense cash flows, and the annual money capital deficit or surplus position of the project

If no amount is entered here, an internal ROR will be computed that may be used to compare the project with alternative investment opportunities.

Borrowing Rate

DEP allows specification of a borrowing rate for computations of the composite ROR. The amount to be borrowed, time for repayment, method of repayment, security provided against the funds borrowed, anticipated conditions in the different money markets, etc., will all typically affect the amount of interest that will have to be paid for borrowed capital. DEP computes borrowing requirements and payback of such financing as rapidly as net cash flows will permit. Truly long-term borrowing costs should be entered on operating cost for composite ROR calculations.

Reinvestment Rate

The reinvestment rate is used when computing the composite ROR for specifying short-term interest earning on monies reinvested from operating cash surpluses. A cash surplus may become available either during the course of the project or after, when certain assets may be liquidated. In the latter case—i.e., when the project's terminal year occurs prior to the year ending a standardized time frame—the program will use the discount rate to determine the post-terminal interest income that might be earned. Such post-terminal calculations are done for both composite and internal ROR.

CARD TYPE 3: Annual price-volume-cost data. One card for each year, up to 21 cards.

The DEP program assumes that all values entered on the Type 3 cards are year-ending values. The data typically used to hypothesize the cash flow characteristics of an investment project are either data projections or forecasts. In either case, the Type 3 card data should be prepared as year-ending values.

Selling Price

The selling price is the value assigned a dry unit of lumber, usually 1,000 board feet (1 MBF). In evaluating a system in which there are many types of drying lumber, the selling price may have to represent an average for the mix.

It is not necessary to specify the exact selling price when doing the "price/cost break-even" analysis, because the selling price is computed (as described) as the price required to cover other price-volume-cost inputs. However, hypothetical values must be entered to indicate anticipated changes in relative values among periods. For example, were a 7 percent price inflation rate expected, $100 may be entered for the first year and $107 for the second year, etc., to establish the program's computational routine of a 7 percent per year increase. Or, if in 3 years it were assumed there would be a business downturn, relative cost inputs could be adjusted to indicate the expected effects on selling price.

Yard Throughput

Yard throughput is the volume of lumber dried and passed through inventory in 1 year. The volume is multiplied by the selling price to calculate annual revenue generated by the drying facilities.

Materials and Handling

These include equipment lumber (pile foundations and bolsters), shipping and handling, and electricity and fuel costs for the equipment used for handling inventory. These are part of the total variable costs of the lumber drying process. They vary directly with the volume of inventory processed.

Labor

In DEP, the labor category includes all labor costs (optionally including supervisory costs) including costs for fringe benefits—e.g., insurance, social security payments, etc. In a traditional accounting sense, a supervisor's salary might be considered overhead cost. For illustration, it was decided to combine labor and supervisory costs to form a basic "labor"-related grouping whose "sensitivity" could be analyzed.

Fixed Manufacturing

Fixed costs are those associated with the physical plant, that must be paid regardless of output. Fixed costs may include rental, interest on borrowed funds, insurance premiums, salaries of top management, property taxes, utility service charges, etc.

Overhead

Overhead costs include repair and maintenance, property tax, facilities insurance, travel, telephone, and contingency costs.

Facilities

These are the costs associated with establishing the fixed assets required for revenue-producing operations. These investments may include costs for replacements, additions, modifications, or repairs that may be incurred to increase a facility's operating capacity, or to extend its useful life. Initial facilities costs are considered part of end-of-Year-0's investment. They continue to be treated as end-of-year investments as such costs may occur in subsequent years. Typical investment or "facilities" costs are those for land, machinery, mobile equipment, engineering, and other costs needed to establish assets necessary for processing operations.

Investment Tax Credit

A credit of 10 percent of the value of investment in manufacturing equipment (having an estimated useful life of 3 years or more) is applied against current tax liabilities. According to IRS rules, this credit may not exceed the current year's tax liability. In DEP, however, investment tax credit and all tax losses are all taken in the year(s) they occur with no carry-back or carry-forward. This assumption is based on the presumption that there will always be a sufficient tax liability for a company to take advantage of the tax "benefits" of any investment tax credit.

Depreciation

Fixed depreciable assets—those to which depreciation allowances may apply—are considered to be those tangible assets that are related to the lumber drying operations and inventory preparation and storage, and that will wear, deteriorate, or waste over time. These assets fall into four broad categories:

1. Land improvements such as fences, drainage systems, grading, pile bases, and bolsters related to the lumberyards and necessary for their functioning,
2. Buildings to protect equipment, roofs for stored lumber, sheds to protect stickers, etc.,
3. Equipment for assembling units for drying, and
4. Forklifts, pickup trucks, and other mobile equipment.

These classifications do not include the land on which lumber is stored as land is a nondepreciable asset.

Because depreciation allowances typically have significant impact on a project's after-tax net cash flows, depreciation should be considered carefully.

CARD TYPE 4: Sequential run control card. One card only. A sequential run control card must follow the last Type 3 card used in the data deck. The number entered on this card determines the number of Type 5 cards read and the number of sequential DEP analyses that will be computed. The purpose of the sequential run option is to simplify the task of preparing data when Type 3 card data may be used as the prototype.

If the Type 4 card is left blank, analyses will be computed and printed on the basis of the data entered on the Type 2 and 3 cards, and no Type 5 cards need to be added to the data deck. If a number 1 through 10 is entered on the Type 4 card, an unaltered analysis of Type 2 and 3 card data will be omitted unless one or more of the following Type 5 cards submitted is entirely blank.

CARD TYPE 5: First year data card. One card for each sequential analysis, up to 10 cards.
By using the sequential DEP analysis option a series of analyses may be made on the basis of adjusted Type 2 and 3 card data—i.e., original cash investment, borrowing rate, lending rate, unit price, unit sales, unit manufacturing costs, other variable costs, fixed manufacturing costs, and overhead costs. The price-volume-cost data entered on Type 5 cards should represent only first-year values. The DEP program will compute the annual sequence of values as a percentage of Type 3 data established by the ratio of card 5 to card 3 first-year values.

Printed Output

Printed output consists of a modified operating statement, with yearly cash flows followed by a sensitivity analysis (tables 1, 2, and 3). The program will solve for different variables on the income statement, depending on the analytic options chosen (figs. 1 and 2). The sensitivity analysis at the bottom of the output indicates the sensitivity of the internal or composite rates of return to changes in five key input variables. Sensitivity is computed as point computations under stated change of revenues, costs, and investment. The sensitivity analysis aids the identification of input variables having the greatest impact on rate of return. Once identified, these key variables can be analyzed more carefully.

Assumptions and Limitations

Although DEP is a powerful tool for analyzing investments in lumber drying facilities, some simplifying assumptions have been made. Because these assumptions may limit the scope of usefulness, they are here clearly identified.

1. Investment tax credits and income tax refunds due to early losses are taken in the year in which they occur. This implies that the firm has sufficient profits from other ongoing activities to take advantage of all tax credits.
2. All cash flows occur on the final day of each period of analysis. Although this method does not represent typical patterns of business transactions it does provide an approximating and easily definable technique.
3. For composite ROR calculations, all borrowing requirements are assumed to be secured as short-term loans with repayment as rapidly as operating cash flows will permit. No loans for the project will be part of the firm's permanent capital structure.
4. Borrowing and reinvestment (lending) rates are considered constant over the periods analyzed.
5. Divestment of facilities occurs at the termination of operating cash flows, with no book gains or losses on the sale or salvage value of assets.

Summary

Because of the particular consideration the DEP program provides for lumber drying investment projects, it can be a valuable tool to assist in the analysis of investments in lumber-drying facilities. DEP's flexibility allows the calculation of rate of return, break-even transfer prices, or break-even facilities costs. Data input requirements are simplified into basic analytical components that may be easily modified for analyses that only require increases or decreases of initial price-volume-cost input data.

Additional Reading

Harpole, George B. A cash flow computer program to analyze investment opportunity in wood products manufacturing. USDA For. Serv. Res. Pap. FPL 305. For. Prod. Lab., Madison, Wis.; 1978.

Harpole, George B., Peter J. Ince, John L. Tschernitz, Edward Bilek. A wood and bark fuel economics com r program (FEP). USDA For. Serv. Res. Pap. FPL 415 Prod. Lab., Madison, Wis.; 1982.

Ince, Peter J. How to estimate recoverable heat energ wood or bark fuels. USDA For. Serv. Gen. Tech. Re FPL-29. For. Prod. Lab., Madison, Wis.; 1979.

Ince, Peter J. and Philip H. Steele. EVALUE: A computer program for evaluating investments in forest products industries. USDA For. Serv. Gen. Tech. Rep. FPL-30. For. Prod. Lab., Madison, Wis.; 1980.

Ince, Peter J. COMPARE: A method for analyzing investment alternatives in industrial wood and bark energy systems. USDA For. Serv. Gen. Tech. Rep. FPL-36. For. Prod. Lab., Madison, Wis.; 1983.

DEP DATA CODING RECORD

Date _____

Estimates prepared by _____

Data confidence level _____

Project _____

Comments _____

CARD TYPE 1: Title card. First card only, columns 2 through /9.

Data entry	

CARD TYPE 2: Data and program control card. Second card only.

Data description	Inventory tax (F6.4)	Working capital (F6.4)	Tax rate (F6.4)	Discount rate (F6.4)	Years considered (12)	Output copies (Max. 9@)			Original cash investment (F9.0)	Short-term rate		Card
						Financial analysis	Price/cost break-even	Facilities break-even		Borrow (F4.4)	Reinvestment (F4.4)	
Cols.	1-6	7-12	13-18	19-24	29-30	34	38	42	46-54	58-61	65-68	80
Data Entry												2

CARD TYPE 3: Annual price-volume-cost data. One card for each year, up to 21 cards.

Data description	Unit price (F7.3)	Yard throughput (F8.0)	Material and handling costs (F10.3)	Labor costs (F10.0)	Utilities (F10.0)	Overhead costs (F10.0)	Facilities costs (F10.0)	Investment tax credit depreciation (F10.0)	Year No.	Card
Cols.	1-7	8-15	16-25	26-35	36-45	46-55	56-65	66-75	79	80
Data entries									0	3
									1	3
									2	3
									3	3
									4	3
									5	3
									6	3
									7	3
									8	3
									9	3

CARD TYPE 4: Sequential run control card. One card only. Maximum of 10 runs.

Data entry	Enter number of sequential runs in columns 9 and 10:	
		4

DEP DATA CODING RECORD--SEQUENTIAL RUN DATA

Date _____

Prototype project _____

Estimates prepared by _____

CARD TYPE 5: First year data card. One card for each sequential analysis, up to 10 cards.

Data description	Unit price (F7.3)	Unit sales (F8.0)	Unit manufacturing costs (F10.3)	Other variable costs (F10.0)	Fixed manufacturing costs (F10.0)	Overhead costs (F10.0)	Original cash investment (F10.0)	Short-term rate: Borrow (F5.4)	Short-term rate: Reinvestment (F5.4)	Card
Cols.	1-7	8-15	16-25	26-35	36-45	46-55	56-65	66-70	71-75	80
Data entry										5
										5
										5
										5
										5
										5
										5
										5
										5
										5
										5

Appendix B—Principal Equations of the Drying Economics Program (DEP)

Most computations involved with calculating the output for the drying economics program involve only addition and subtraction. The more complex calculations are explained:

Working capital

Because this money must be on hand at the beginning of the year, working capital is entered as an end-of-year value for the preceding year. Working capital (WRK) is computed as:

$$WRK(K) = (TVC(K + 1) + TFC(K + 1) - ITI(K + 1)) * WKR - TWC(K - 1)$$

where

K = current,
TVC = total variable cost,
TFC = total fixed cost,
ITI = inventory tax and insurance,
WKR = percent of annual production in inventory, and
TWC = total working capital.

After-tax profit

$$ATP = (REV - (INT + TVC + TFC + DEP)) * (1 - TXRT)$$

where

REV = revenue,
INT = interest expense (used only to compute composite rate of return),
DEP = depreciation, and
TXRT = tax rate.

After-tax earnings

$$ATE = ATP + DEP$$

After-tax net cash flow

$$ATNCF(K) = ATE(K) - INV(K)$$

where

INV = year's investment.

Accumulated net cash flow

$$ANCF(K) = ANCF(K - 1) + ATNCF(K)$$

Appendix C—Listing of Drying Economics Computer Program (DEP)

```
      DIMENSION  ACF(20),   ATE(20),   ATP(20),   BORS(10),   DEBT(20),
     1 DEP(20),  DEPR(20),  DEPX(20),  EQUI(20),  FAC(20),    FACC(20),
     2 FACX(20), FMFC(20),  FMFS(10),  FXR(20),   GRIR(20),  GSAL(20),
     3 INVE(20), IRR(27),   NCF(20),   ORES(10),  OTFC(20),  OTFS(10),
     4 OTVC(20), OTVS(10),  PCON(20),  REIN(20),  RTLS(10),
     5           TITLE(13), TFCX(20),  TMFC(20),  TMVC(20),  TOFC(20),
     6 TOVC(20), TOWR(20),  TSVC(20),  TVCX(20),  UMFC(20),  UMFS(10),
     7 UNVC(20), UPRI(20),  UPRS(10),  UPRX(20),  UPRY(20),  USAL(20),
     8 USAS(10), USAX(20),  WORK(20),
     9 BASE(20), TINV(20), RMKT(20), TINS(20), COIN(20)
C
C     DATA AND MODE INFORMATION
C
      INTEGER YN, PN, PT, J, OPT1, OPT2, OPT3
       REAL IRR, NCF, INVE, INVO, INCR
C
C     INITIALIZE ARRAYS
C
      DO 2000  K=1,20
       ACF(K)=0.0
       ATE(K)=0.0
       ATP(K)=0.0
       DEBT(K)=0.0
       DEPR(K) = 0.0
       EQUI(K) = 0.0
       FACC(K) = 0.0
       FMFC(K) = 0.0
       FXR(K) = 0.0
       GRIR(K)=0.0
       GSAL(K)=0.0
       INVE(K) = 0.0
       OTFC(K) = 0.0
       TOFC(K)=0.0
       NCF(K)=0.0
       PCON(K)=0.0
       REIN(K)=0.0
       TOVC(K)=0.0
       TMVC(K)=0.0
       TSVC(K) = 0.0
       UNVC(K)=0.0
       USAL(K) = 0.0
       UPRI(K) = 0.0
       WORK(K)=0.0
       BASE(K) = 0.0
       TINV(K) = 0.0
       RMKT(K) = 0.0
       TINS(K) = 0.0
       COIN(K) = 0.0
 2000 CONTINUE
C
C     INPUT FORMAT
C
  110 FORMAT (13A6)
  120 FORMAT(4F6.4,4X,I2,3(3X,I1),3X,F9.0,2(3X,F4.4))
  121 FORMAT(55X,2F10.0)
  130 FORMAT (F7.3,F8.0,F10.3,5F10.0)
  131 FORMAT(8X,I2)
  132 FORMAT(F7.3,F8.0,F10.3,4F10.0,2F5.4)
C
C     OUTPUT FORMAT
C
  210 FORMAT (1H1,25X,13A6)
```

```
      211 FORMAT(1H1,25X,13A6//////////)
      212 FORMAT(38X,'(INVESTMENT TAX CREDIT OF $',F8.0,' CONSIDERED.)')
      215 FORMAT(//
     $        '  INITIAL INVESTMENT--YEAR 0',7X,'EFFECTIVE TAX RATE ',
     1F5.4,5X,'ORIGINAL CASH EQUITY',5X,'$',F9.0,5X,'V.C./TOT TRAN REV='
     2,F6.4/'   FACILITIES COST $',F9.0,6X,'BORROWING RATE',5X,F5.4,5X,
     3'ENDING VALUE OF EQUITY   $',F9.0,5X,'F.C./TOT TRAN REV=',F6.4/
     4'   WORKING CAPITAL $',F9.0,6X,'REINVESTMENT RATE  ',F5.4,5X,
     5'FACILITIES SALVAGE VALUE $',F9.0,5X,'DEPR./T.T.R.     =',F6.4)
      205 FORMAT(5X,'TOTAL INVEST. $',F9.0,6X,'INTERNAL ROR',6X,F6.4,5X,
     1'P.V. OF INVEST.(I=',F5.4,') $',F9.0,5X,'TAX COSTS/T.T.R. =',F6.4
     2/104X,'A.T. PROFIT/T.R. =',F6.4)
      206 FORMAT(5X,'TOTAL INVEST. $',F9.0,6X,'COMPOSITE ROR',5X,F6.4,5X,
     1'P.V. OF EQUITY(I=',F5.4,')  $',F9.0,5X,'TAX COSTS/T.T.R. =',F6.4
     2/104X,'A.T. PROFIT/T.T.R=',F6.4)
      216 FORMAT (57X,'FINANCIAL SUMMARY'/)
      217 FORMAT (39X,'OPERATING CASH FLOWS WHERE COSTS = REVENUES'/)
      218 FORMAT (22X,'FINANCIAL SUMMARY WITH BREAK-EVEN ADJUSTED FACILITIES
     1 COST(S), DEPRECIATION AND OVERHEAD'/)
      220 FORMAT(' YEAR-END VALUES . . .  ',
     1            'YEAR 1',5X,'YEAR 2',5X,'YEAR 3',5X,'YEAR 4',5X,
     1'YEAR 5',5X,'YEAR 6',5X,'YEAR 7',5X,'YEAR 8',5X,'YEAR 9',4X,
     2'YEAR 10')
      221 FORMAT(' YEAR-END VALUES . .  YEAR 11',4X,'YEAR 12',4X,'YEAR 13',
     1  4X,'YEAR 14',4X,'YEAR 15',4X,'YEAR 16',4X,'YEAR 17',4X,'YEAR 18'
     2 ,4X,'YEAR 19',4X,'YEAR 20')
      230 FORMAT(' YARD THRUPUT',7X,10(F11.0)/' TRANS. PRICE/UNIT',2X,
     1   10('$',
     1 F9.2,1X)/4X,'TOT TRAN REVENUE',10('$',F10.0)//
     1' INTEREST INC-EXP',
     2 3X,10(F11.0)//' MAT. & HANDL. COST',1X,10('$',F10.0)/
     3 ' INV. TAX & INSUR.',2X,10(F11.0)/' LABOR COST',9X,10(F11.0)/3X,
     4 ' TOTAL VAR COST',
     5  2X,10('$',F10.0)/4X,'UNIT VAR COST',3X,10('$',F9.2,1X)//
     6  ' PROFIT CONTRIB.',4X,10('$',F10.0)//' FIXED MFG COST',5X,
     7  10('$',F10.0)/' OVERHEAD COST',6X,10(F11.0)/4X,'TOTAL F.C.',
     8  6X,10('$',F10.0)//' FACILITIES COST',4X,10('$',F10.0)/
     9  ' WORKING CAPITAL',4X,10(F11.0)/4X,'INVESTMENT',6X,10('$',F10.0)
     1  //' DEPRECIATION',7X,10('$',F10.0)//' AFTER TAX PROFIT',3X,
     2  10('$',F10.0)/' A.T. EARNINGS',6X,10(F11.0)/' A.T. NET CASH FLOW
     3',1X,10(F11.0)//' ACUM NET CASH FLOW',1X,10('$',F8.1,'M',1X)/)
      231 FORMAT(' BEGINING-OF-YEAR VALUES FOR MONIES . . .'/
     $        8X,'BORROWED',4X,10('$',F8.1,'M',1X)/8X,'REINVESTED',2X,
     110('$',F8.1,'M',1X)//)
      235 FORMAT (49X,'SENSITIVITY ANALYSIS'//
     +  35X,'INTERNAL RATES OF RETURN AT ADJUSTED INPUT VALUES'/
     +  33X,'80 PCT',6X,'90 PCT',5X,'100 PCT',5X,'110 PCT',5X,'120 PCT')
      236 FORMAT (49X,'SENSITIVITY ANALYSIS'//
     +  35X,'COMPOSITE RATES OF RETURN AT ADJUSTED INPUT VALUES'/
     +  32X,'80 PCT',6X,'90 PCT',5X,'100 PCT',5X,'110 PCT',5X,'120 PCT')
      237 FORMAT (5X,'YARD THRUPUT',15X,5(F5.3,7X))
      238 FORMAT (5X,'TRANS. PRICE/UNIT',10X,5(F5.3,7X))
      239 FORMAT (5X,'UNIT VAR COST',14X,5(F5.3,7X))
      240 FORMAT (5X,'TOTAL F.C.',17X,5(F5.3,7X))
      241 FORMAT (5X,'FACILITIES COST',12X,5(F5.3,7X)///)
C
C     READ STATEMENTS
C
      READ (5,110),TITLE
      READ(5,120),SER,WKR,TAXP,DISR,YN,OPT1,OPT2,OPT3,OREQ,HORT,RTLE
      READ(5,121),FA0, INCR
      DO 330 K = 1,YN
       READ (5,130),UPRI(K), USAL(K), UMFC(K), OTVC(K), FMFC(K), OTFC(K)
     1 , FACC(K), DEPR(K)
        FAC(K) = FACC(K)
        DEP(K) = DEPR(K)
```

```
  330 CONTINUE
      READ(5,131), NX
      IF(NX.LT.1) GO TO 2005
      DO 331 K=1,NX
        READ(5,132), UPRS(K), USAS(K), UMFS(K), OTVS(K), FMFS(K),
     2               OTFS(K), ORES(K), BORS(K), RTLS(K)
  331 CONTINUE
C
C     SEQUENTIAL ANALYSIS CONTROLS
C
        JK = 0
        OPTX = OPT1
        OPTY = OPT2
        OPTZ = OPT3
      BOR = BORT
      ORE = OREQ
        RTL = RTLE
      FA = FAO
      RIS = INCR
 2003 CONTINUE
      IF(JK.EQ.NX) WRITE (6,210), TITLE
      IF(JK.EQ.NX) GO TO 334
       JK = JK + 1
       OPT1 = OPTX
       OPT2 = OPTY
       OPT3 = OPTZ
       OREQ = ORES(JK)
       BORT = BORS(JK)
       RTLE = RTLS(JK)
      FAO = FA
      INCR = RIS
      FMF = 1.0
      OTF = 1.0
      OTV = 1.0
      UMF = 1.0
      UPR = 1.0
      USA = 1.0
      IF(FMFC(1).GT.0.1) FMF = 1.0 / FMFC(1)
      IF(OTFC(1).GT.0.1) OTF = 1.0 / OTFC(1)
      IF(OTVC(1).GT.0.1) OTV = 1.0 / OTVC(1)
      IF(UMFC(1).GT.0.1) UMF = 1.0 / UMFC(1)
      IF(UPRI(1).GT.0.1) UPR = 1.0/ UPRI(1)
      IF(USAL(1).GT.0.1) USA = 1.0/ USAL(1)
      DO 2002 K=1,NX
      IF(UPRS(K).LT.0.1) UPRS(K) = UPRI(1)
        IF(USAS(K).LT.0.1) USAS(K)= USAL(1)
        IF(UMFS(K).LT.0.1) UMFS(K)= UMFC(1)
        IF(OTVS(K).LT.0.1) OTVS(K)= OTVC(1)
        IF(FMFS(K).LT.0.1) FMFS(K)= FMFC(1)
        IF(OTFS(K).LT.0.1) OTFS(K)= OTFC(1)
 2002 CONTINUE
      IF(BORT.LT.0.0001) BORT = BOR
      IF(OREQ.LT.0.0001) OREQ = ORE
      IF(RTLE.LT.0.0001) RTLE = RTL
      DO 2004 K= 1,YN
      UPRI(K) = (UPPS(JK) * UPRI(K)) * UPR
      USAL(K) = (USAS(JK) * USAL(K)) * USA
      UMFC(K) = (UMFS(JK) * UMFC(K)) * UMF
      OTVC(K) = (OTVS(JK) * OTVC(K)) * OTV
      FMFC(K) = (FMFS(JK) * FMFC(K)) * FMF
      OTFC(K) = (OTFS(JK) * OTFC(K)) * OTF
       DEPR(K) = DEP(K)
       FACC(K) = FAC(K)
 2004 CONTINUE
 2005 CONTINUE
      TAX=1-TAXR
```

```
      PT = 0
       DO 70 K= 1,YN
       FXR(K) = (OTFC(K) + 0.001)/FAO
   70  UPRY(K)= UPRI(K)
C
C     ANALYSIS AND PRINT OPTION CONTROLS
C
 2010 IF(OPT1.LT.1) GO TO 2011
       PN= OPT1
       J = 0
       GO TO 1000
 2011 IF(OPT2.LT.1) GO TO 2012
       PN= OPT2
       J = 26
       IBE = 1
       GO TO 1000
 2012 IF(OPT3.LT.1) GO TO  2003
       PN= OPT3
       J = 26
       IBE = 2
C
C     CASH FLOW CALCULATIONS
C
 1000 CONTINUE
 1003 DO 1005 K=1,YN
        GSAL(K) = UPRI(K) * USAL(K)
        TMVC(K) = UMFC(K) * USAL(K)
        TOFC(K) = FMFC(K) + OTFC(K)
      BASE(K) = ((TMVC(K) + OTVC(K) + TOFC(K)) * WKR)
      TINS(K) = 0.01 * BASE(K)
      BMKT(K) = GSAL(K) * WKR
      IF(BMKT(K).LT.BASE(K)) BASE(K) = BMKT(K)
      TINV(K) = SER * BASE(K)
      TSVC(K) = TINV(K)
      COIN(K) = TINV(K) + TINS(K)
        TOVC(K) = TMVC(K) + COIN(K) + OTVC(K)
 1005 CONTINUE
 1006 DO 1010 K=1,YN
      USX = 1.0
      IF(USAL(K).GT.1.0)  USX = 1.0 / USAL(K)
        UNVC(K) = TOVC(K) * USX
        TMFC(K) = TOFC(K) + TOVC(K)
 1010 CONTINUE
       WOR = WKR * (TMFC(1) - TSVC(1))
       TOWR(1) =  WKR * (TMFC(2) - TSVC(2))
       WORK(1) = TOWR(1) - WOR
      INVE(1) = FACC(1) + WORK(1)
      DO 1020 K=3,YN
      IF(USAL(K).LT.1.0) GO TO 1021
       TOWR(K-1) = WKR * (TMFC(K) - TSVC(K))
       WORK(K-1) = TOWR(K-1) - TOWR(K-2)
      INVE(K-1) = FACC(K-1) + WORK(K-1)
      IK = K
 1020 CONTINUE
 1021  SUMF = FAO
        SUMD = 0.0
      FACC(IK) = 0.0
      DO 1030  K=1,YN
       SUMF = SUMF + FACC(K)
        SUMD = SUMD + DEPR(K)
 1030 CONTINUE
      SALF = SUMF - SUMD
      FACC(IK) =(-1.0)* SALF
      WORK(IK) =   TOWR(IK-1) *(-1.0)
      INVE(IK) = FACC(IK) + WORK(IK)
      INVO = FAO + WOR
```

```
261.            BBAL = OREQ - INVO
262.            ACFX = INVO *(-1.0)
263.            IF(OREQ.LT.1.0) RORT = 0.0
264.            IF(OREQ.LT.1.0) RTLE = 0.0
265.            DO 1075 K=1,YN
266.            IF(BBAL)94,99,95
267.         94 REIN(K)= BBAL * RORT
268.            DEBT(K)= BBAL * (-0.001)
269.            EQUI(K) = 0.0
270.            GO TO 96
271.         95 IF(USAL(K).LT.1.0) RTLE = DISR/TAX
272.             REIN(K)= BBAL * RTLE
273.            DEBT(K)= 0.0
274.            EQUI(K) = BBAL * 0.001
275.            GO TO 96
276.         99 REIN(K) = 0.0
277.            DEBT(K)= 0.0
278.            EQUI(K) = 0.0
279.         96 CONTINUE
280.              GPIR(K) = REIN(K) + GSAL(K)
281.              PCON(K) = GRIR(K) - TOVC(K)
282.              ATP(K) = TAX * (PCON(K) - TOFC(K) - DEPR(K))
283.            IF(K.EQ.1) ATP(1) = ATP(1) + INCR
284.              ATE(K) = ATP(K) + DEPR(K)
285.              NCF(K) = ATE(K) - INVE(K) + 0.0001
286.            ACFX = ACFX + NCF(K)
287.            ACF(K) = ACFX * 0.001
288.            BBAL = ACFX + OREQ
289.       1075 CONTINUE
290.            IF(PT.EQ.1) GO TO 801
291.       C
292.       C       RATE OF RETURN CALCULATIONS
293.       C
294.            J = J + 1
295.            IF(J.GT.26) GO TO 31
296.            IF(OREQ.LT.10) GO TO 9
297.            IF(BBAL) 7,7,8
298.         7 RR = 100.0
299.            GO TO 80
300.         8 RLG = ALOG(BBAL/OREQ)/ YN
301.           RLG = EXP(RLG)
302.           RR= RLG - 1.0
303.           GO TO 80
304.         9 RR= DISR
305.           IX=3
306.           IXX=6
307.           IC=3
308.           ICC=6
309.           IM=3
310.           IMM=6
311.       700 CONTINUE
312.           PVR = (-INVO)
313.           DO 71 K=1,YN
314.           PVR =PVR + NCF(K)/(1.0 + RR)**K
315.        71 CONTINUE
316.           IF(IX.EQ.IXX) GO TO 74
317.           IF(PVR) 73,80,72
318.        72 IX=1
319.           RR=RR + 0.100
320.           GO TO 700
321.        73 IXX=1
322.           RR=RR - 0.100
323.           IF(RR.LT.-0.9) GO TO 80
324.           GO TO 700
325.        74 IF(IC.EQ.ICC) GO TO 77
326.           IF(PVR) 76,80,75
```

```
      75 IC=1
         RR=RR + 0.010
         GO TO 700
      76 ICC=1
         RR=RR - 0.010
         GO TO 700
      77 IF(IM.EQ.IMM) GO TO 80
         IF(PVR) 79,80,78
      78 IM=1
         RR=RR + 0.001
         GO TO 700
      79 IMM=1
         RR=RR - 0.001
         GO TO 700
      80 IRR(J)=RR
         IF(J-1)333,31,33
C
C     PRESENT VALUE CALCULATIONS
C
   31 PVI = 0.0
         IF(OREQ.LT.1.0) GO TO 3
         PVI =(BBAL/(1.0 + DISR)**YN) - OREQ
         GO TO 4
    3 DO 32 K = 1,YN
         PVI = PVI + NCF(K)/((1.0 + DISR)**K)
   32 CONTINUE
         PVI  = PVI - INVO
    4 CONTINUE
         IF(J.GT.26) GO TO  (870,880), IRE
   33 GO TO (808,810,810,810,810,820,820,820,820,820,830,830,830,830,
     1830,840,840,840,840,840,850,850,850,850,850,860),J
C
C     SENSITIVITY ANALYSES
C
  808 PVX = PVI  + OREQ
         FAX = FAO * 0.1
         RINX = INCR * 0.1
         ORX = OREQ * 0.1
         VR = 0.0
         FR = 0.0
         PR = 0.0
         GR = 0.0
         DR = 0.0
         DO 1085 K = 1,YN
           TFCX(K) = TOFC(K)*0.1
           FACX(K) = FACC(K)*0.1
           DEPX(K) = DEPR(K)*0.1
           TVCX(K) = TOVC(K)*0.1
           USAX(K) = USAL(K)*0.1
           UPRX(K) = UPRI(K)*0.1
         VR = VR + TOVC(K)
         FR = FR + TOFC(K)
         DR = DR + DEPR(K)
         PR = PR + ATP(K)
         GR = GR + GRIP(K) - REIN(K)
 1085 CONTINUE
         GRX = 1.0/GR
         VCTR = VR * GRX
         FCTR = FR * GRX
         DPTR = DR*GRX
         PTPR = PR * GRX
         TXTR = 1.0 - VCTR - FCTR - PTPR - DPTR
  810 DO 41 K=1,YN
   41 TOFC(K) = TFCX(K)*(J+7)
         GO TO 1006
  820 IF(J-6)333,821,822
```

```
      821 DO 44 K=1,YN
       44 TOFC(K) = TFCX(K)*10.0
      822 DO 45 K=1,YN
          FACC(K) = FACX(K)*(J+2)
       45 DEPR(K) = DEPX(K)*(J+2)
          FAO = FAX * (J +2)
          OREQ = ORX * (J+2)
          INCR = RINX * (J+2)
          GO TO 1006
      830 IF(J-11)333,831,832
      831 DO 46 K=1,YN
          FACC(K) = FACX(K)*10.0
       46 DEPR(K) = DEPX(K)*10.0
          FAO = FAX * 10.0
          OREQ = ORX * 10.0
          INCR = RINX * 10.0
      832 DO 47 K=1,YN
       47 TOVC(K)= TVCX(K)*(J-3)
          GO TO 1006
      840 IF(J-16)333,841,842
      841 DO 48 K=1,YN
       48 TOVC(K)= TVCX(K)*10.0
      842 DO 49 K=1,YN
       49 USAL(K)=USAX(K)*(J-8)
          GO TO 1003
      850 IF(J-21)333,851,852
      851 DO 50 K=1,YN
       50 USAL(K)=USAX(K)*10.0
      852 DO 51 K=1,YN
       51 UPRI(K)=UPRX(K)*(J-13)
          GO TO 1003
      860 IF(J-26)333,861,870
      861 DO 52 K=1,YN
       52 UPRI(K)=UPRX(K)*10.0
          PT = 1
          GO TO 1000
C
C     WRITE STATEMENTS
C
  801 WRITE (6,210),TITLE
      IF(INCR.GT.1.0) WRITE(6,212), INCR
      IF(OREQ.LT.1.0) RTLE = 0.0
      WRITE(6,215),TAXR,OREQ,VCTR,FAO,BORT,BBAL,FCTR,WOR,RTLE,SALF,DPTR
      IF(OREQ.GT.1.0) GO TO 804
      WRITE(6,205),INVO,IRR(1),DISR,PVX,TXTR,PTPR
      GO TO 805
  804 WRITE(6,206),INVO,IRR(1),DISR,PVX,TXTR,PTPR
  805 IF(OPT1.LT.1) GO TO 802
       WRITE(6,216)
       GO TO 806
  802 IF(OPT2.LT.1) GO TO 803
       WRITE(6,217)
       GO TO 806
  803 IF(OPT3.LT.1) GO TO 2003
       WRITE(6,218)
  806 WRITE (6,220)
       WRITE(6,230),(USAL(K),K=1,10),(UPRI(K),K=1,10),(GSAL(K),K=1,10),
     1(PEIN(K),K=1,10),
     1(TMVC(K),K=1,10),(COIN(K),K=1,10),(OTVC(K),K=1,10),(TOVC(K),K=1,10
     2),(UNVC(K),K=1,10),(PCON(K),K=1,10),(FMFC(K),K=1,
     310),(OTFC(K),K=1,10),(TOFC(K),K=1,10),(FACC(K),K=1,10),(WORK(K),K=
     41,10),(INVE(K),K=1,10),(DEPR(K),K=1,10),(ATP(K),K=1,10),(ATE(K),K=
     51,10),(NCF(K),K=1,10),(ACF(K),K=1,10)
       IF(OREQ.GT.1.0)
     $WRITE(6,231),(DEBT(K),K=1,10),  (EQUI(K),K=1,10)
       IF(YN.LT.11) GO TO 809
```

```
459.            WRITE(6,211), TITLE
460.            WRITE(6,221)
461.            WRITE(6,230),(USAL(K),K=11,20),(UPRI(K),K=11,20),(GSAL(K),K=11,20)
462.           1  ,(REIN(K),K=11,20),(GRIP(K),K=11,20),(TMVC(K),K=11,20),(COIN(K),
463.           2  K=11,20),(OTVC(K),K=11,20),(TOVC(K),K=11,20),(UNVC(K),K=11,20),
464.           3  (PCON(K),K=11,20),(FMFC(K),K=11,20),(OTFC(K),K=11,20),(TOFC(K),
465.           4  K=11,20),(FACC(K),K=11,20),(WORK(K),K=11,20),(INVE(K),K=11,20),
466.           4  (DEPR(K),K=11,20),(ATP(K),K=11,20),(ATF(K),K=11,20),
467.           5  (NCF(K),K=11,20),(ACF(K),K=11,20)
468.            IF(OREQ.GT.1.0)
469.           $WRITE(6,231),(DEBT(K),K=11,20),(EQUI(K),K=11,20)
470.         809 CONTINUE
471.            IF(OREQ.LT.1.0) WRITE(6,235)
472.            IF(OREQ.GT.1.0) WRITE(6,236)
473.            WRITE(6,238),(IRR(J),J=17,21)
474.            WRITE(6,237),(IRR(J),J=22,26)
475.            WRITE(6,239),(IRR(J),J=12,16)
476.            WRITE(6,240),(IRR(J),J=2,6)
477.            WRITE(6,241),(IRR(J),J=7,11)
478.            PN=PN - 1
479.            IF(PN.GT.0) GO TO 801
480.            PT= 0
481.            IF(OPT1.LT.1) GO TO 54
482.            OPT1 = 0
483.            GO TO 2011
484.           54 IF(OPT2.LT.1) GO TO 56
485.            DO 55 K = 1, YN
486.           55 UPRI(K) = UPRY(K)
487.            OPT2 = 0
488.            GO TO 2012
489.           56 IF(OPT3.LT.1) GO TO 2003
490.            IF (IBE.EQ.2) GO TO 2003
491.            GO TO 2012
492.       C
493.       C      UNIT PRICE BREAK-EVEN CALCULATION
494.       C
495.         870 SGSL = 0.0
496.            DO 87 K=1,YN
497.           87  SGSL = SGSL + GSAL(K)/(1.0 + DISR)**K
498.            PRBE = 1.0 - (PVI/(TAX * SGSL))
499.            DO 63 K=1,YN
500.           63 UPRI(K) = UPRI(K) * PRBE
501.            IF(PVI) 60,900,61
502.           60 IF(PVI+100.0) 1000,900,900
503.           61 IF(PVI-100.0) 900, 900, 1000
504.         900 J = 0
505.            GO TO 1000
506.       C
507.       C      FACILITIES AND DEPRECIATION BREAK-EVEN CALCULATIONS
508.       C
509.         880 FABE = 1 + ((PVI * 0.3)/ FAO)
510.            FAO = FAO * FABE
511.            OREQ = OREQ
512.            INCR = INCR * FABE
513.            DO 65 K=1,YN
514.            DEPR(K)= DEPR(K) * FABE
515.            FACC(K)= FACC(K) * FABE
516.            OTFC(K) = FXR(K) * FAO
517.           65 CONTINUE
518.            IF(FAO.LT.1.0) GO TO 901
519.            IF(PVI) 66,901,67
520.           66 IF(PVI+100.0) 1000,901,901
521.           67 IF(PVI-100.0) 901, 901, 1000
522.         901   J= 0
523.            GO TO 1000
524.         333 GO TO 2003                                    2.5-24-7/83
525.         334 STOP
526.            END
```

U.S. Forest Products Laboratory

DEP—A Computer Program for Evaluating Lumber Drying Costs and Investments, by Stewart Holmes, George B. Harpole, and Edward Bilek. Madison, Wis., For. Prod. Lab., 1983.

20 p. (USDA For. Serv. Gen. Tech. Rep. FPL-37)

The DEP computer program is a modified discounted cash flow program designed for analysis of problems involving economic analysis of wood drying processes. DEP's flexibility allows calculation of rate-of-return, break-even transfer prices, or break-even facilities costs. Data input requirements are simplified into basic analytical components that are explained and illustrated with example analyses.

Keywords: Discounted cash flow analysis, forest products utilization economics, engineering economy, lumber drying, investment analysis, computer programs, lumber drying costs.

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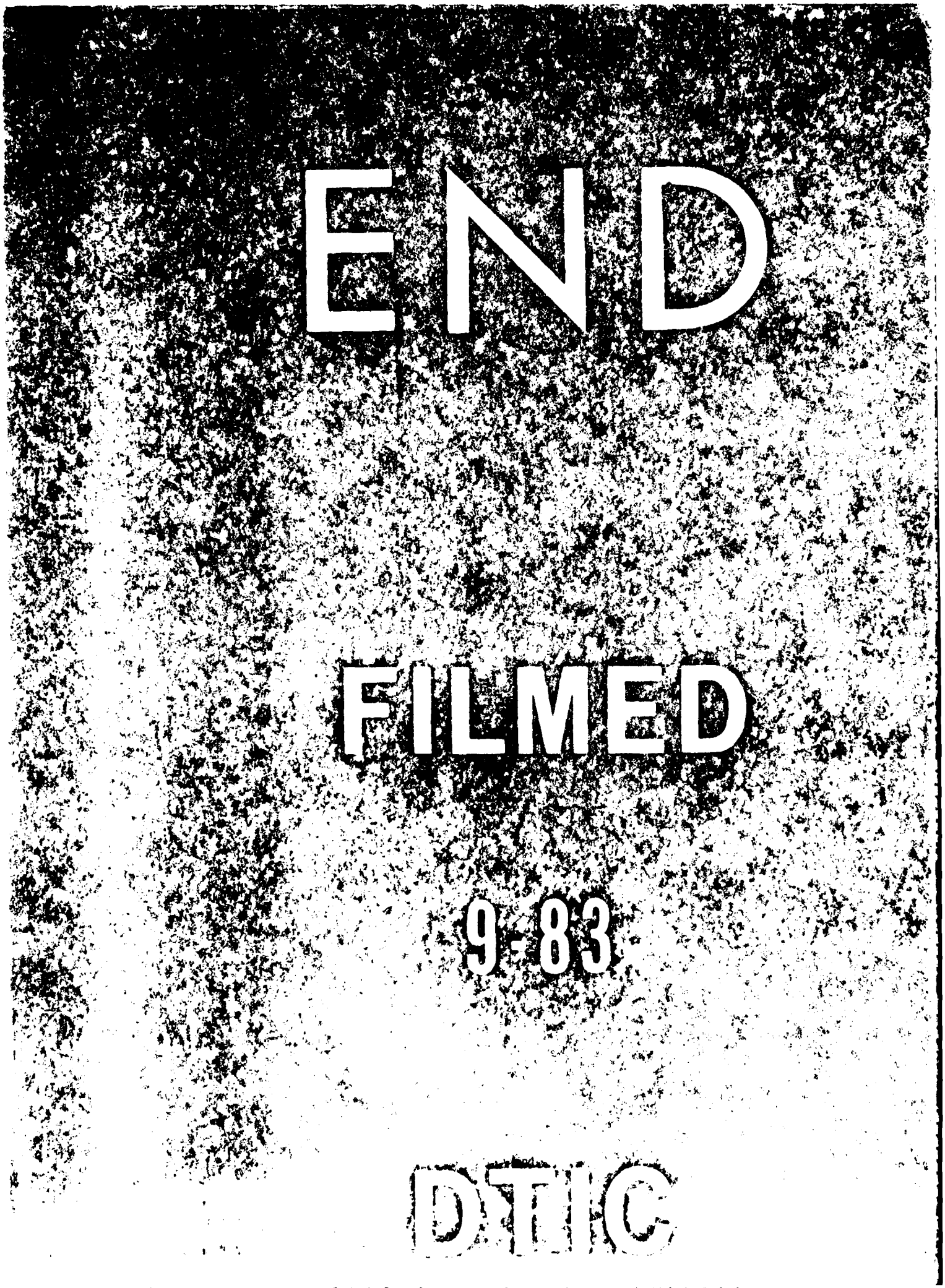
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